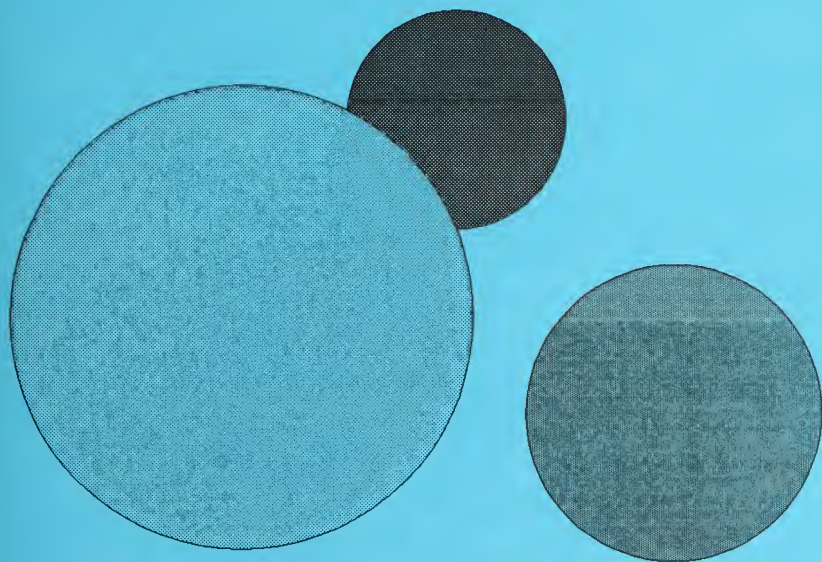


Guide

to Selecting Instructional Materials for Mathematics Education



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Mathematics***

***The National Council of Supervisors of
Mathematics***

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Foreword

The selection of appropriate instructional materials is critical to the implementation of effective mathematics instruction. Available materials are in a state of evolution influenced largely by expanding technology. Educators are no longer limited to the use of textbooks alone. To keep abreast of the changing paradigm for mathematics instruction, the Association of State Supervisors of Mathematics (ASSM) and the National Council of Supervisors of Mathematics (NCSM) established a joint Instructional Materials Committee to prepare this set of guidelines for the selection of instructional materials in mathematics. Support for the committee was provided through a grant from the Carnegie Foundation.

We would like to thank committee members for their efforts over the past year in developing this document and the members of ASSM and NCSM who extensively reviewed earlier drafts.

We hope that the *Guide* will help you improve mathematics education by providing assistance with the selection of instructional materials.

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Introduction

The *Curriculum and Evaluation Standards for School Mathematics* and the *Professional Standards for Teaching Mathematics* (hereafter referred to as the Standards) present a vision for the reform of mathematics programs in our schools. They provide a broad framework to guide reform during this decade. The development of the Standards is, however, only the initial step in a long, complex process to change school mathematics. There are many issues not specifically addressed in the Standards that will need solutions to accomplish the changes needed in our school mathematics programs. To be addressed are questions such as "How much and what kind of professional development will teachers need?" and "What changes will be made in instructional materials so that they reflect the envisioned program?" Also, "How will changes in technology impact the mathematics program?"

This document addresses one critical issue – the selection of instructional materials for a high-quality mathematics program. It is consistent with, and builds on, the NCTM position statement, "Professional Standards for Selection and Implementation of Instructional Materials." (See Appendix, page 18.) Many of the recommendations in this document are taken directly from the 1984 NCTM position statement, broadening the concepts about possible formats and contents of instructional materials.

Traditionally, basal textbooks have been the primary component of mathematics programs, with ancillary materials such as workbooks and manipulative materials being somewhat separate. Since the textbook could stand alone, the student book could be the basis for evaluation. This may no longer be true for new mathematics programs. For example, a teacher's manual may be the primary component, manipulative materials and technology may be fully integrated into the program, and a hard-bound student text may not be included.

Use of this Document

This document is intended to provide guidance and support to school/district personnel who are responsible for reviewing, evaluating, and selecting instructional materials in mathematics. It is not meant to be comprehensive nor prescriptive. It may need to be modified to meet local situations and needs.

This document is organized into the following four sections:

- Determining the Criteria for Evaluating Instructional Materials
- Establishing a Review and Selection Committee
- Evaluating and Selecting Instructional Materials
- Next Steps

Each section addresses a number of important aspects of the evaluation process. It is critical that those responsible for the process do careful planning. If possible, written procedures, along with a time line, should guide the selection process so that all

personnel, as well as the public, can be well informed. Determining in advance how decisions will be made or problems handled, can make the process run more smoothly.

The sample evaluation criteria and many of the procedural suggestions primarily were written to be used for evaluation of materials for complete mathematics programs rather than for supplemental materials. Evaluating materials for a year-long course or for one or several grade levels is more complex than selecting materials for a portion of the program. However, the criteria and suggestions can be adapted. For example, if a school or district is selecting a book of problem-solving activities, the school or district might decide to use the Student Experience category from the sample evaluation criteria and some of the points from the Teacher's Role category and not use the Organization and Structure category. Local decisions need to be made about what suggestions in this document are appropriate for a particular situation.

Instructional materials for a complete mathematics program may have several components. This document suggests that all of the program's components such as student written materials, teacher support materials, manipulative materials, technology used in the program, and assessment materials be reviewed together. Evaluators should consider how the various materials will be used by typical, effective teachers so that students experience a high-quality mathematics program.

As district and school educators use this document, they may find that many current materials do not match the criteria presented herein. As a result, it may be tempting to select materials that fall far short of what is desired. Rather than continuing to settle for inadequate materials, mathematics educators should convey their desires and needs to publishers. Publishers need to know that there is a market for innovative instructional materials that reflect the Standards.

Implications of the Standards for Instructional Materials

The NCTM Standards are the basis for many of the recommendations in this document. The Standards do not specifically describe instructional materials to be used in mathematics classrooms. However, they make several fundamental implications about instructional materials relevant to implementing programs that are based on the Standards. Some important points from the Standards are listed below. This is followed by a list of implications of the Standards for instructional materials. (See page 12 for a suggested training activity for the evaluation committee.)

NCTM Standards: Important Points

- Educational goals for students must reflect the importance of mathematical literacy.
- The NCTM Standards articulate five goals for all students:
 - learning to value mathematics
 - becoming confident in one's own ability to do mathematics
 - becoming a mathematical problem solver
 - learning to communicate mathematically
 - learning to reason mathematically

- The goal of teaching mathematics is to help all students develop mathematical power.
- What students learn is fundamentally connected with how they learn it.
- All students can learn to think mathematically.
- Teaching is a complex practice and hence not reducible to recipes or prescriptions.
- Knowing mathematics is doing mathematics.
- Some aspects of doing mathematics have changed in the last decade.
- Changes in technology and the broadening of the areas in which mathematics is applied have resulted in the growth and changes in the discipline of mathematics itself.
- The main purpose of evaluation is to help teachers better understand what their students know and to make meaningful decisions.

Implications for Instructional Materials

- Materials reflect current research in mathematics education.
- Materials include, and consequently promote, an appreciation of the role of mathematics as it relates to culture, history, science, and technology.
- Materials provide numerous and varied experiences that encourage students to develop trust in their own mathematical thinking.
- Materials use an integrated problem-solving approach that reflects the spirit and nature of the problem-solving process.
- Materials provide ongoing opportunities for students to clarify, refine, and consolidate their ideas, and to communicate through reading, writing, and discussion.
- Materials require students to make conjectures, gather evidence, and develop arguments to support their reasoning.
- Materials require students to use a variety of mathematical methods to solve nonroutine problems.
- Materials emphasize the development of conceptual understanding.
- Materials emphasize how mathematics should be taught as well as what should be taught.
- Materials reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background.
- Materials reflect an appropriate developmental sequence while allowing for teacher flexibility.

- Materials ensure active student participation in learning, creating, doing, and evaluating mathematics.
- Materials are current and reflect the diverse uses and applications of mathematics.
- Materials reflect the changes in the nature of how mathematics is done.
- Materials integrate technology and reflect the impact of technological advances.
- Materials model multiple means of assessment that can be integrated with instruction, assessing what students know, what students can do, and how students think about mathematics.

Determining the Criteria for Evaluating Instructional Materials

The Evaluation Instrument

The criteria used for evaluating and selecting instructional materials should be aligned with the NCTM Standards and based on current research on the teaching and learning of mathematics. The criteria might be similar to the example at the end of this section (pages 6 - 10) or could be developed at the district or state level to also meet local needs and requirements. Evaluation instruments developed locally should be done by a person (or small group) with expertise in mathematics education, ideally by an individual who also has experience teaching the grade levels or courses for which the instructional materials will be selected.

A *scoring scheme* for the evaluation instrument will need to be established. This document does not recommend a particular scoring scheme as there is no single correct or best scheme. Questions that will need to be addressed in establishing a scoring scheme include the following:

- Will holistic evaluation, analytic evaluation, or a combination of the two be used?
- What will be the rating scale? Will criterion be rated using a 4-point, a 5-point, or other scale? Will evaluators be permitted to give a rating that is between points on the scale? Say a 3.5? What about a 3.9? (Allowing decimal ratings greatly expands the number of points on a scale.)
- Will different criteria or categories be weighted differently? How should the relative weights be established? Should the highest possible total of the weighted scores be 100 or some arbitrary number?
- Should an "acceptable" score be set in advance and then other factors such as the cost of various programs be considered before selecting a program? What if no program is rated "acceptable?"
- Will individual evaluators be asked to score each program, or will the scores be determined by the committee?

Analytic and Holistic Evaluation

All evaluations involve making judgments about what is being evaluated. In general, there are two approaches to evaluation: analytic and holistic.

Analytic evaluation involves the use of many criteria, with a rating given for each criterion. Then an overall score is determined based on a mathematical formula (which may assign different weights to different criteria). A checklist is an example. Textbook evaluation forms, in which a number of categories are identified with subpoints to be independently rated, are analytical.

Holistic evaluation involves making a general judgment about a piece of material. The assumption is that the whole is greater than the sum of the parts. With holistic scoring,

one is looking for the best fit, rather like determining the correct size when buying clothes.

Holistic evaluation has been used to score writing samples, problem solving, and for judging many things that are complex in nature.

Holistic evaluation does not have to be just one overall judgment or score. It can be done in several categories. What distinguishes holistic from analytic scoring is whether the evaluator is asked to make judgments on a whole or on the parts.

The sample criteria on pages 6 - 10 could be used as a holistic evaluation instrument by asking evaluators to assign an overall score to a set of instructional materials or to assign one score for each category and then weighting the categories for an overall score. The same criteria could be used analytically by asking the evaluators to assign a score to each of the items in the five categories and then weighting each item to provide a category score and finally an overall score.

At first glance, analytic evaluation may appear to be more objective than holistic evaluation since many more ratings are included in determining a total score. Yet the question is, "Are many judgments, averaged together, about relatively smaller aspects of a program, more indicative of the overall quality of a program than fewer judgments?" In the sample criteria, each item is not a simple straight-forward statement that can be easily checked off but requires sophisticated judgments based upon what is pervasive throughout a set of materials. Even narrower statements require subtle judgments. For example, suppose one criterion is, "The materials develop students' ability to use problem-solving strategies." Judging this criterion is not cut and dried; it is not a matter of counting up the number of lessons on "problem-solving strategies." In fact, an evaluator might rate this criterion low even though a program asks students to frequently identify their problem-solving strategies but expects students to learn and use the strategies in procedural ways.

In holistic evaluation of instructional materials, an evaluator makes fewer judgments and has the opportunity to look at how all the components work together. The example criteria on problem-solving strategies, stated above, is still important, but it is not examined in isolation. It is used with other statements to judge the overall quality of a program.

The following is a comparison of analytic and holistic evaluation:

Analytic Evaluation

Many criteria are judged independently and combined, using a mathematical formula to produce an overall score.
Ex: Looking at the trees.

Making many judgments can be tedious, which can affect the judgments made.

Holistic Evaluation

Judgment is made on the whole—the whole is greater than the sum of its parts. (Holistic ratings may be given in several, but not numerous, categories, rather than in a single overall score.)
Ex: Looking at the forest.

An understanding of the overall picture is required. The evaluator must consider how the program as a whole will function.

The overall computed score may not match the holistic impression of the program, or ranks of competing programs may not line up with holistic impressions.

Evaluators may overlook specific deficiencies in a program, or strengths in one area may inflate overall judgment of the program.

Sample Criteria for Evaluating Instructional Materials

Below is a sample set of criteria for evaluating instructional materials. The criteria are based on the *Curriculum and Evaluation Standards for School Mathematics* and the *Professional Standards for Teaching Mathematics*. Much of the wording is directly from these documents. The example below is only one model; it should be reviewed and revised for use in a district's particular setting. To be used as an evaluation instrument, a scoring procedure, including weightings for the different categories, should be added.

Since instructional materials for a program could be in a variety of formats, the sample criteria have not been organized into categories synonymous with the format. High-quality instructional materials may be unintentionally penalized if the evaluation instrument includes categories or criteria such as student textbook, teacher's manual, and supplementary materials.

Rather, the categories offer the opportunity to examine the materials from different perspectives. In this sample, the criteria are organized into the following categories.

1. Mathematical Content
2. Organization and Structure
3. Student Experiences
4. Teacher's Role
5. Assessment

Each category is used to look at instructional materials from a different perspective. The categories are not distinct; they overlap. For example, while the mathematical content category describes *what* students study, content cannot be completely separated from *how* students work. What should be considered is how all the aspects and the components of the program work together so that students' experiences are of high quality.

When using the criteria, all the components of the instructional materials (that will be purchased) should be considered as they typically will be used together in the classroom. Many components of a program may be designed to be used together. The following are examples of components that may be considered:

- teacher's guide
- calculators/computers
- computer software
- manipulative materials
- teaching materials,(e.g., overhead transparencies, posters, or bulletin board materials)
- distance learning materials
- staff development materials
- materials for parents (e.g., sample letters to parents, suggestions for family projects)
- textbook
- student activity sheets
- laser discs
- video tapes
- student assessment materials
- program assessment materials

Category 1: Mathematical Content

The mathematical content of the program reflects the curriculum Standards.

- Mathematics as problem solving is built into the program at all levels. The mathematics is developed from problem situations. Situations are sufficiently simple to be manageable but sufficiently complex to provide for diversity in approach. They are amenable to individual, small-group, or large-group instruction; involve a variety of mathematical domains; and are open and flexible as to the methods to be used.
- Mathematics as communication is built into the program at all levels. Students have many opportunities to use language to communicate their mathematical ideas. The program asks students to explain, conjecture, and defend their ideas orally and in writing. As students mature and develop, the program expects students' mathematical communication to become more formal and symbolic. Students are asked to form multiple representations of ideas, express relationships within and among representation systems, and formulate generalizations.
- Mathematics as reasoning is built into the program at all levels. Throughout the program, students are asked to explain and justify their thinking and to question the statements of other students and the teacher. As students mature, the program asks students to do both inductive and deductive reasoning. In Grades 9-12, the program expects mathematically mature students to use informal and formal arguments to support conclusions.
- Mathematical connections are clear in the program; the program approaches mathematics as a whole. Concepts, procedures, and intellectual processes are interrelated through specific instructional activities designed to connect ideas and procedures among different mathematical topics, with other content areas, and to life situations.
- The program is comprehensive and includes the mathematics content emphasized in the Standards at each level.

Grades K-4

Estimation
Number Sense and Numeration
Concepts of Whole Number
Operations
Whole Number Computation
Geometry and Spatial Sense
Measurement
Statistics and Probability
Fractions and Decimals
Patterns and Relationships

Grades 5-8

Number and Number
Relationships
Number Systems and Number
Theory
Computation and Estimation
Patterns and Functions
Algebra
Statistics
Probability
Geometry
Measurement

Grades 9-12

Algebra
Functions
Geometry from a Synthetic
Perspective
Geometry from an Algebraic
Perspective
Trigonometry
Statistics
Probability
Discrete Mathematics
Conceptual Underpinnings of
Calculus
Mathematical Structure

Category 2: Organization and Structure

The program is organized into cohesive units, multiday lessons, and worthwhile tasks.

- The program is organized into units, modules, or other structure so that students have sufficient time to explore and investigate in-depth major mathematical ideas. The units or modules include lessons, activities, and projects that are multiday, emphasize the connections between mathematical concepts, and promote the attainment of several, rather than just one, instructional objectives.
- The program asks students to work on worthwhile mathematical tasks. The tasks do not separate mathematical thinking from mathematical concepts or skills; they capture students' curiosity and invite them to speculate and to pursue their hunches. Many tasks in the program can be approached in more than one interesting and legitimate way; some have more than one reasonable solution. The tasks require that students reason about different strategies and outcomes, weigh the pros and cons of alternatives, and pursue particular paths.
- The instructional materials incorporate calculators and computers and other technology into the program as tools for students to use to do mathematics. The program is designed with the expectation that calculators are available to all students at all times and that all students have access to a computer for individual and group work.
- The program is appropriate for *all* students. All students are expected to encounter typical problem situations related to important mathematical topics. All students are expected to experience mathematics in the context of the broad, rich curriculum described in the K-8 Standards. However, the program recognizes that students will differ in the vocabulary or notations used, the complexity of their arguments, and so forth. For Grades 9-12, all students participate in the core program, with explicit differentiation in terms of depth and breadth of treatment and the nature of applications for mathematically mature students.

Category 3: Student Experiences

The program emphasizes students *doing* rather than *memorizing* mathematics. Students are actively involved with mathematics.

- The program is designed so that students are active learners. Students are encouraged to explore and investigate mathematical ideas. They are expected to read, write, and discuss mathematics. The program asks students to conjecture, test, and build arguments about a conjecture's validity. Students are asked to reason about different strategies and outcomes, weigh the pros and cons of alternatives, and pursue varied paths when working on tasks. Students are expected to work on group and individual projects and assignments.
- Students are expected to construct their own understanding of mathematics. The program recognizes that students approach a new task with prior knowledge and encourages students to use natural language and informal procedures.

- The program asks students to engage in mathematical discourse. The materials ask students to talk with one another, as well as to respond to the teacher. Students are expected to make public conjectures and reason with others about mathematics. Students are asked to clarify and justify their ideas orally and in writing.
- Students use manipulatives and technology to explore mathematical ideas, model mathematical situations, analyze data, calculate numerical results, and solve problems. Generally, students decide what tools are needed and when to use them.
- Students are expected to determine when they need to calculate in a problem and whether they require an exact or approximate answer. Students are expected to choose an appropriate procedure when calculating, whether it is using paper-and-pencil, mental calculation, or a calculator.
- Students are expected to reflect on, make judgments about, and report on their own behavior, performance, and feelings. Students are asked to do self-assessment on selected aspects of their experiences as one method for evaluating student performance and disposition.

Category 4: Teacher's Role

The instructional materials provide suggestions to teachers to assist them in shifting toward the vision of teaching presented by the Standards.

- The instructional materials provide suggestions to teachers so that in tasks and lessons teachers can help students to:
 - work together to make sense of mathematics
 - rely more on themselves to determine whether something is mathematically correct
 - reason mathematically
 - learn to conjecture, invent, and solve problems
 - connect mathematics, its ideas, and its applications to other topics within mathematics and to other disciplines
- The instructional materials provide suggestions for teachers in initiating and orchestrating mathematical discourse. The materials suggest questions that elicit, engage, and challenge students' thinking. Teachers are encouraged to regularly follow students' statements with, "Why?" and "What if?" Also, teachers should ask students to explain their thinking and reasoning.
- The instructional materials provide assistance to teachers to facilitate learning by all students. Suggestions are provided on how to use a variety of methods so that all students can contribute to the thinking of the class. Students are expected to express themselves in writing and pictorially, concretely and representationally, as well as orally. The program encourages teachers to accept and respect the thinking of all students by providing examples of how to probe students' thinking and encourage students to follow and understand each others' approaches and ideas.

- The instructional materials provide suggestions to teachers for establishing a classroom learning environment focused on sense making. Teachers are provided suggestions on how to:
 - structure the time so students can grapple with significant mathematical ideas and problems
 - use physical space and material in ways that facilitates students' learning
 - assist students to work together collaboratively, as well as independently
- The instructional materials provide suggestions to teachers to help them reflect on what happens in the classroom so that they can adjust or adapt their teaching plans. Teachers are provided suggestions on how to observe, listen to, and gather other information so they can assess and monitor student learning. Teachers also are provided suggestions on how to examine the effect of the task, discourse, and learning environment in promoting students' understanding of mathematics.
- The instructional materials provide suggestions for how parents can be involved and kept informed about the program.

Category 5: Assessment

The student assessment in the instructional materials provides teachers with information about what their students know and how they think about mathematics.

- Student assessment is integrated into the instructional program. Assessment activities are similar to learning activities. Assessment activities examine the extent to which students have integrated and made sense of information, whether they can apply it to situations that require reasoning and creative thinking, and whether they can use mathematics to communicate their ideas.
- Multiple means of assessment are used, informal as well as formal. Suggestions are provided for assessing students, individually or in small groups, through observations, oral and written work, student demonstrations or presentations, and student self-assessment. The use of calculators, computers, and manipulatives are built into assessment activities. Assessment is built into the instructional materials as a continuous, dynamic, and often informal process.
- All aspects of mathematical knowledge and how they are interrelated are assessed in the instructional materials. However, assessment is not of separate or isolated competencies, although one aspect of mathematical knowledge might be emphasized more than another in a particular assessment. Conceptual understandings and procedural knowledge are frequently assessed through tasks that ask students to apply information about a given concept in novel situations.

Establishing a Review and Selection Committee

Committee Membership

The school district should establish a selection committee for mathematics instructional materials. The committee should consist of classroom teachers, mathematics specialists, and administrators. Additional persons who may be considered to serve on the committee include media specialists, computer consultants, special education representatives, Chapter I teachers, and representatives of key interest groups such as parents, businesses, partnerships, and the school board. Consideration should be given to balancing the committee in terms of ethnic and socioeconomic background, gender, and grade level representation. However, in an attempt to provide for this balance, districts should not lose sight of the fact that members of the committee should be selected because of their subject-matter and pedagogical knowledge and expertise.

Professional Integrity

The instructional materials selection process must be fair; the integrity of the process must be ensured. Those involved in any way with instructional materials should not benefit from their participation in the process. The district must ensure that there is no conflict of interest or appearance of impropriety. Voting members of the selection process should not have financial interest in any programs or materials being considered. In addition, to ensure consistency and equity, guidelines for contact and interactions between vendors and committee members should be established. For example, the guidelines may address:

- formal presentations by publishers to the committee
- the attendance at workshops seminars and other special events sponsored by individual publishers
- contact between publishers' representative and individual members of the committee

Training for the Committee

Prior to the actual review and evaluation of instructional materials, the committee needs to participate in staff development activities in two areas:

- curricula and instructional practices that reflect current standards for mathematics education
- the use of the criteria and the evaluation instrument

Staff development on current curricular and instructional practices is important to provide a common base for judging instructional materials. Some committee members such as parents and administrators may not be familiar with the NCTM Standards and other mathematics education reform documents. Also, individuals may have quite different ideas about what goes on in classrooms that are implementing recommended practices. A presentation by an outside expert (if one is not available locally) on current research in

learning and teaching mathematics may be considered. Hands-on mathematics activities, followed by discussions of the activities, can help committee members clarify how the Standards might be reflected in instructional materials.

One possible training activity relates to the Implications of the Standards for Instructional Materials on page 2 of this document. Have the committee list important ideas from the Standards and then discuss and list the implications the Standards have for instructional materials. The committee may want to go beyond the implications and brainstorm ways the implications might be manifested in instructional materials. Encourage the committee members not to limit their thinking to familiar kinds of materials but to extend their thinking to alternative, but reasonable, possibilities.

The committee also needs to be trained on the use of the evaluation instrument so that all will use it in a consistent way. The committee should have enough discussion to be reasonably comfortable that all members are reading and interpreting the criteria in the same way and that a score means the same thing regardless of which committee member determines it. A simulation of an evaluation, using the evaluation instrument and materials that are not being considered for adoption, helps to establish consistency. (See pages 14 - 15 for additional suggestions for promoting reliability and consistency among evaluators.)

Evaluating and Selecting Instructional Materials

The actual process of evaluating and selecting instructional materials can involve a number of different aspects which are described below. Decisions about whether to include all aspects and whether the suggestions are applicable to a particular situation should be made locally.

Identification of Instructional Materials

A concerted effort should be made to identify all appropriate instructional materials to be evaluated. Publishers and vendors frequently contact school systems to sell their materials. Other publishers may be identified at national and regional NCTM (and affiliate) meetings. Instructional materials developed by nonprofit organizations as well as commercial publishers should be sought out and considered.

Publishers' Presentations

Providing an opportunity for publishers/authors/vendors to present their instructional materials to the committee can be helpful. They can point out features of their programs that may be overlooked by the reviewers. Guidelines about the presentations may help ensure that all presentations address some of the same areas. For example, the publishers may be asked to provide a brief overview of how their materials are organized and then describe the content and instructional approaches. It may be desirable to have all presenters address specific areas (e.g., how their materials address mathematical connections, how their programs develop student understandings of statistical concepts through the grade levels). A question and answer period may be included at the end of the presentation.

All presenters should have an equitable amount of allocated time. The time should be sufficient so that the publishers can adequately present the materials, while considering the overall amount of committee time for presentations. Fifteen minutes is too short to adequately present a K-8 program (although it may be sufficient for supplementary material). However, an hour may be too long for the attention span of committee members, especially if several publishers have programs to present. To ensure equity, all other access of publishers to the committee should be restricted during the review period.

Committee Process

After the training period, sufficient time must be made available for committee members to review and evaluate instructional materials, particularly if a number of different programs are to be evaluated. Reviewers need adequate time, outside of committee meetings, to become thoroughly familiar with each program prior to the time for selection. Ideally, they should have some time before the publishers' presentations to examine materials. Knowledge about the materials gained during the presentations may be helpful as they review materials in more depth before meeting with other committee members. The amount of time needed for individual review should be reasonable and based on the quantity of materials. In some instances, subcommittees might focus most

of their efforts on particular materials such as for a span of grade levels or a particular course.

Some meetings might be structured so that the materials are examined in a variety of ways. A few examples are:

- in-depth reviews of materials for a grade level (or particular course) by committee members who have expertise at the grade level (or course)
- reviews across grade levels to see how concepts are developed over time
- comparisons of how different programs develop the same concept. For example, at second grade, the committee might want to trace the development of place value ideas. Different programs would be placed side-by-side so that the experiences students will have in each may be compared.

Committee meetings should be collaborative. Committee members should be encouraged to share and discuss their findings. They should discuss the materials in relation to the evaluation criteria (and, therefore, indirectly, to the Standards). They should frequently refer to illustrative examples in the materials to support their observations and conclusions.

Consistency and Reliability Among Evaluators

When several evaluators individually judge instructional materials, holistically or analytically, no assurance exists that evaluators will judge and rate materials using similar standards. Also, no assurance can be given that an individual will apply the evaluation criteria in the same way when rating materials from different publishers (or when rating the same materials at different times). Of critical importance is the fairness of the evaluation process. The ratings of different materials must not be affected by which committee members review the materials or whether they reviewed the materials at a time when they were tired. In this section, *consistency* refers to the extent evaluators apply the criteria in the same way, and *reliability* refers to the extent each evaluator applies the criteria in the same way to different materials or to the same materials at different times.

To promote consistency and reliability among the evaluators, the district can:

- use professionally active mathematics teachers and coordinators as a majority of the evaluators
- establish a common base of agreement through inservice education and discussion on what constitutes a quality mathematics program. The NCTM Standards and other recent documents should be used as resources. Inservice education is particularly important for nonexpert evaluators. In-depth discussions help evaluators clarify *quality* in their own minds. For example, a discussion could be held around the question: "What might you see in instructional materials (or in a classroom) that would be evidence that students will develop the ability to solve problems?"
- use committee members with specific expertise or interests (e.g., businessmen and women, parents, multicultural representatives, technology specialists, educators of students with special needs) to examine specific aspects of the program

- train the evaluators in the use of the evaluation instrument. Practice using the instrument, if possible, with materials that will not be formally evaluated. For example, a simulated evaluation using materials from another country, old textbooks, or alternative materials can help develop greater reliability among evaluators if they discuss the reasons for their ratings.
- provide time for individuals to thoroughly review all instructional materials to be evaluated and to share and discuss their reviews and findings in the committee. Consider the possibility of evaluators working in pairs or teams.
- encourage evaluators to come to consensus, rather than voting individually. This provides the opportunity for each evaluator to consider aspects that may have been overlooked when a program was individually reviewed. The strategy paves the way for a program to be successfully implemented.
- encourage sharing of and respect for all opinions. In the absence of consensus on materials, realize conscientious people will frequently disagree. Decisions about the materials may be able to accommodate differing views. For example, schools or teachers may be provided a number of choices of materials.
- encourage evaluators to justify their ratings, orally and in writing, and to include examples to support their evaluation

Pilot Testing

Piloting instructional materials with students can provide useful information about how a program will work. However, if not carefully thought out, piloting can result in teachers developing a bias for (or against) products they pilot. Some suggested guidelines to consider include the following:

- Conduct a pilot test only after a thorough evaluation of materials.
- Conduct a pilot if several programs receive a top evaluation and only if the pilot will provide information that cannot be obtained through the evaluation process.
- Pilot similar components of competing programs. Pilot only those components that will be considered for purchase.
- Distribute pilots evenly among different student populations and among teachers. Perhaps, permit only committee members to pilot.
- Rotate programs that are piloted after a set period of time so that teachers have an opportunity to use each one and to reduce the potential for bias.

Public Input and Challenge Process

Teachers and administrators not on the committee, parents, and the general public should have an opportunity to review materials being considered for selection and to provide input to the committee. Instructional materials being reviewed can be displayed in a central location so that all interested parties have access to them.

The selection of instructional materials may produce complaints about the process or the materials finally selected. A procedure for handling concerns or complaints should be defined prior to the selection process.

Materials Selection

The committee should have the primary responsibility for selecting instructional materials. Those who have not participated in the extensive review and evaluation process should not have a determining influence. For example, voting by all teachers in a district may be counterproductive to the selection process.

In the committee, ratings of the instructional materials using the evaluation instrument can be done individually, in subgroups, or by the full committee. Ratings should be done only after members of the committee have thoroughly discussed the materials and shared observations. If no agreement is reached on the program to select, the committee might recommend conducting a pilot or allowing schools to select from the top programs. If committee members determine that no program meets the criteria, they might recommend delaying the purchase of instructional materials.

The goal should be to identify the best possible program, not the program that is the easiest to implement. Difficulties in implementation should be considered only if they seem insurmountable since any adoption of new instructional materials will create some problems of implementation.

The instructional materials recommended by the committee should be adopted unless irregularities in the selection process are documented. Since the cost of instructional materials is only a small fraction of any school's budget, the cost of these materials should not be a factor. Potential financial savings do not justify the selection of less desirable materials.

Other Issues

Districts and states may have specific requirements that will impact the selection process. These need to be incorporated into the selection process from the beginning. If any policies are inconsistent with the selection of quality instructional materials in mathematics, every effort should be made so the potential conflicts can be resolved.

The committee may want to address some issues, not specifically part of mathematics, as they review instructional materials. (These issues may, or may not, be addressed in district or state requirements.) One important issue is equity. Beyond the obvious examination of materials for gender and ethnic diversity in illustrations and in problem situations, the committee may want to consider how the materials provide support so that all students can be successful in the program. For example, are suggestions made as to how teachers can work with students whose primary language is not English? Are student materials translated into other languages? Are options given so students who wish to delve more deeply into a topic can be challenged? Are students encouraged to work with other students and to listen to and to value diverse points of view?

Next Steps

The work does not end with the selection of a particular series or collection of materials. The task of assisting teachers to implement a quality mathematics program with new instructional materials lies ahead and is the most important part of the process. An inservice component should be part of a long-term commitment to the professional development of all teachers of mathematics.

All change is difficult, even for those who desire it. Mathematics staff development for teachers who will implement new materials should have begun long before the materials are selected. Understanding current recommendations and their implications for classroom practices is critical. In schools that are trying to implement the Standards, teachers will welcome new instructional materials that are aligned with their efforts. Even so, it will take additional time and effort for these teachers to become familiar and comfortable with using new materials. For teachers who are unaware of the national recommendations for changes in mathematics education, an ongoing inservice program that focuses on issues in the Standards and other documents will be necessary for successful implementation of new instructional materials.

Prior to implementation, teachers need specific information on new materials. Information may address the following: the various components of a program (e.g., student materials, technology, manipulatives) and how they are integrated, how the program is organized, the program's assessment philosophy, recommendations for program management, etc.

At the same time, inservice education for new instructional materials often can be integrated with the broader issues of mathematics reform. For example, some of the information about the new materials might be delivered through hands-on activities that model classroom activities. Following the activities, teachers can discuss the rationale for the teaching approaches and how they reflect the Standards.

Teachers need ongoing support especially throughout the first year of implementation. Grade-level meetings can provide teachers opportunities to share information on how they use the materials to improve their mathematics program and to identify further areas that need to be addressed.

Appendix

Professional Standards for Selection and Implementation of Instructional Materials

(NCTM Position Statement, approved by the Board of Directors, April 1984)

The content, organization, and style of instructional materials, particularly basal textbooks, are among the most important factors influencing outcomes of school mathematics programs. Thus, the process of selecting new textbooks and ancillary materials is a critical step in planning curricula and preparing for instructions. This process includes setting criteria, screening materials, making choices, and implementing the new program. Although teachers and students are vitally concerned with the quality of the instructional materials they must use, the selection and preparation for use of those materials are often constrained by inappropriate selection and implementation processes.

In order to improve curriculum and instruction in elementary and secondary mathematics programs, the National Council of Teachers of Mathematics has adopted the following standards for selecting instructional materials and implementing programs using those materials. The Council urges compliance with these standards by all school districts.

Standard 1: The Review and Selection Committee

The entire process of instructional materials selection should be led by teachers and supervisors with expertise and responsibility in mathematics education. Except in most unusual circumstances the recommendations of the committee must be followed.

Membership on the Review and Selection Committee should include, but not necessarily be limited to, classroom teachers representing the grades or courses for which instructional materials are being selected as well as teachers in grades or courses that precede or follow the target courses; mathematicians or mathematics educators with knowledge of content, curriculum, and pedagogical trends covering the full spectrum of K-12 mathematics and beyond; and school administrators who have overall responsibility for supporting and guiding the implementation of new programs.

Selection of committee members must be made in consultation with a person having expertise and responsibility in mathematics education. Whoever is chosen should be a full working member. Where the talents of a school or district mathematics staff cannot fulfill the roles described above, appropriate outside consultants should be obtained.

Standard 2: Criteria for Selection of Instructional Materials

Criteria for selection must be defined and made public prior to the review process.

The criteria should identify the desired instructional approach as well as the mathematics content. Criteria for selection should be based on program needs, which can be identified by:

- evaluation of the present program, including analysis of student achievement, attitudes and learning characteristics, and a survey of teacher opinions;

- current research on the teaching and learning of mathematics;
- recommendations of professional organizations; and
- curriculum guidelines of local, state or provincial, and national governments.

Difficulties in implementation should be considered only if they seem insurmountable. Any adoption of new instructional materials will create some problems of implementation. However, the committee's goal should be the identification of the best possible program, not the easiest to implement.

Copyright dates and formula-determined reading levels are generally inappropriate as selection criteria. Although fashions in content and pedagogy change, a newer (or older) copyright does not assure higher quality. Because of the large technical vocabulary associated with mathematics, results of standard readability formulas should be used with extreme caution.

Standard 3: The Review of Instructional Materials

The Review and Selection Committee should actively seek materials from a variety of sources and evaluate the materials on the basis of the previously defined criteria.

The committee should consult the following sources to identify appropriate instructional materials:

- critical review in professional journals;
- recommendations of teachers and supervisors in the district and in nearby districts with similar characteristics and goals;
- recommendations or authorizations of state or provincial committees where they exist;
- independent information bases such as the National Diffusion Network; and
- representatives of all publishers of appropriate material.

Instructional materials developed by not-for-profit organizations as well as commercial publishers should be considered. Whenever possible, committee representatives should examine materials displayed at a national or regional NCTM meeting. Interviews with members of the author team or a publisher's representative may also be helpful.

Once the materials for review have been collected, each should be evaluated for:

- content coverage and development of each major curricular strand;
- development of the full range of cognitive abilities, especially problem solving and analysis;
- correlation of the content with local state or provincial, or national scope-and-sequence guidelines;

- correlation of the content and instructional approach with the standards of mathematics professional organizations;
- correlation between textual features and characteristics of special students;
- evidence of success based on publishers' field validation studies, implementation in other districts, critical review in professional journals and reports, or local field testing where possible; and
- representation of the diversity of national social, political, and economic life.

Since instructional materials comprise a small fraction of any school's budget, the cost of the materials should not be a factor. Potential financial savings do not justify the selection of less desirable materials. Where textbooks are accompanied by ancillary materials, however, it is important to assess the extent to which successful use of the text depends on such extra materials

Standard 4: Implementation of New Instructional Materials

The selection of new instructional materials must be only part of a careful curriculum development process that includes appropriate in-service preparation for teachers and supervisors and a formal evaluation of the new program's effectiveness.

In-service preparation should acquaint all teachers with the general program goals and the emphasis for each topic in every course. This emphasis should, where possible, be identified in terms of the appropriate number of instructional days to be devoted to each topic, and the topics should be correlated with specific portions of the new instructional materials. In-service should provide the additional mathematics background and preferred instructional approaches to the mathematics content.

Implementation should include periodic evaluation surveys of teachers' and students' reactions to the materials as well as an analysis of student achievement. Results of these evaluations should be used to evaluate the achievement of the program goals and plan for ongoing modification of the program. Implementation is typically more successful when such in-service support continues throughout the academic year.

Standard 5: Professional Integrity

The instructional materials selection process must not allow influences that compromise the professional integrity of the process.

Any person connected with the process of selection and implementation of instructional materials who has a financial interest in any program being considered must make that interest known publicly at the outset. For the duration of the selection process those involved must not accept gifts of travel, entertainment or materials from a vendor.

The instructional materials recommended by the Selection Committee must be adopted unless irregularities in the selection process are documented.

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